Name: _____ ( ) Class: _____

MONTFORT SECONDARY SCHOOL

PRELIMINARY EXAMINATIONS 2025

Secondary 4 Express (G3)

CHEMISTRY

Paper 3 Practical

6092/03
12 August 2025
1h 50 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions in the spaces provided.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.
Qualitative Analysis Notes for this paper are printed on page 14.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Shift
Laboratory

For Examiner's Use	
1	
2	
3	
Total	

This document consists of **13** printed pages and **1** blank page.

Setter: Miss Celine Peh

1 You are provided with:

- an aqueous solution of ethanedioic acid, **X**
- 0.800 mol / dm^3 aqueous sodium hydroxide, NaOH, **Y**.
- thymolphthalein indicator

You are going to investigate the reaction between **X** and **Y** and calculate the concentration, in mol / dm^3, of ethanedioic acid in **X**.

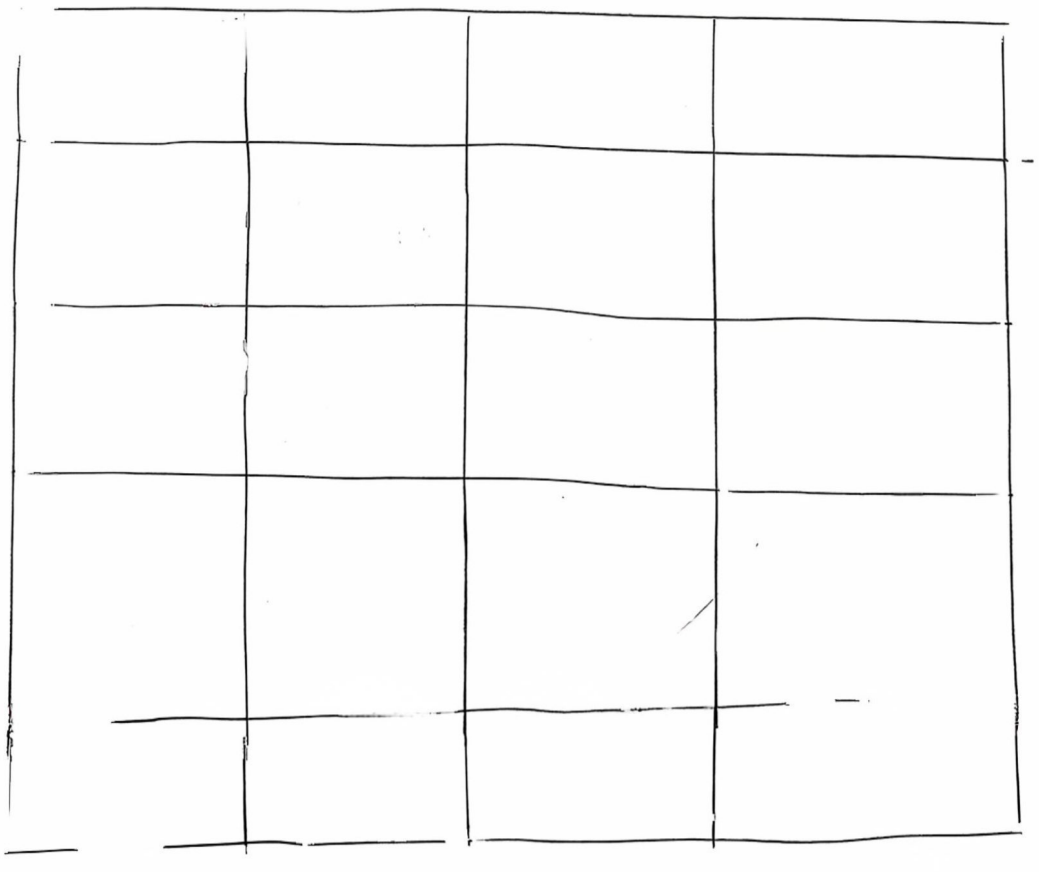
Read all the instructions carefully before starting the experiments.

Instructions

(a) (i)

- Fill the burette with **X**.
- Use the pipette to transfer 25.0 cm^3 of **Y** into the conical flask.
- Add five drops of thymolphthalein indicator to the conical flask.
- Place the conical flask on a white tile.
- Add **X** from the burette while swirling the flask, adding drop by drop near the end-point, until the solution just changes colour.
- Record your results in an appropriate format in the space provided. Repeat the titration as many times as you consider to be necessary to achieve consistent results.

Results



[4]

(ii) From your titration results, calculate the average volume of **X** needed to neutralise 25.0 cm^3 of **Y**.

volume = ... cm^3 [1]

(iii) Calculate the number of moles of NaOH in 25.0 cm^3 of **Y**.

number of moles = ... [1]

(iv) One mole of ethanedioic acid is neutralised by two moles of sodium hydroxide.

Use your answers from **(aii)** and **(aiii)** to calculate the concentration, in mol / dm^3, of ethanedioic acid in **X**.

Give your answer to **three** significant figures.

concentration = ... mol / dm^3 [3]

(b) The formula of ethanedioic acid is $C_2H_2O_4 \cdot nH_2O$.

(i) **X** contains 6.3 g of $C_2H_2O_4 \cdot nH_2O$ in 100 cm^3 of solution.

Use your answer from **(aiv)** to calculate the relative formula mass, M_r, of $C_2H_2O_4 \cdot nH_2O$.

M_r = ... [2]

(ii) Use your answer from **(b)(i)** to deduce the value for n in $C_2H_2O_4 \cdot nH_2O$.

Give your answer to the nearest whole number.

[A_r: H, 1; C, 12; O, 16]

n = ... [1]

(c) (i) State why the conical flask is placed on a white tile before **X** is added from the burette.

..... [1]

(ii) A student completes this experiment but consistently misses the end-point. The student's average volume of **X** added is slightly higher than it should be.

Explain why this error is unlikely to change the calculated whole number value of *n* in **(bii)**.

.....

.....

.....

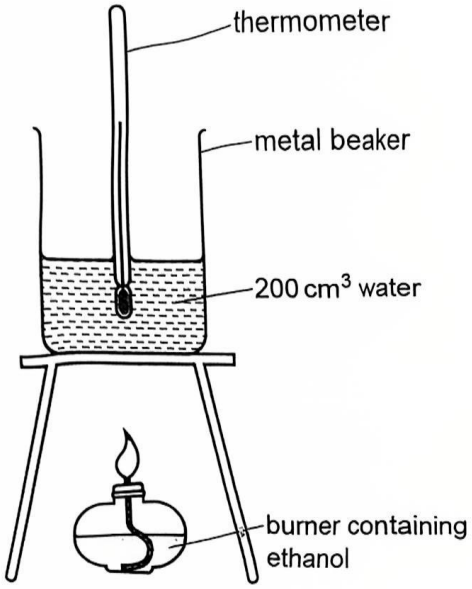
..... [2]

[Total: 15]

for

2 A student investigates the amount of heat released when ethanol burns.

The diagram shows the apparatus the student uses.



(a) The student burns a known mass of ethanol.

The heat released is used to heat 200 cm^3 of water.

The student determines the temperature rise of the water while the ethanol is burning.

(i) In the first experiment the student burns 1.0 g of ethanol and the temperature rises by 20 °C.

State all the measurements the student makes to obtain these values.

.....

..... [2]

(ii) Why is a metal beaker used instead of a glass beaker?

..... [1]

(iii) The student finds out that 1.0 g of ethanol should give a theoretical temperature rise of more than 20 °C.

Suggest **two** reasons why the temperature rise of the water was less than the theoretical value.

1 .....

2 ..... [2]

(b) The experiment is repeated using the same number of moles of different alcohols.

The temperature rises are shown in the table.

number of carbon atoms in each alcohol molecule	temperature rise / °C
2	20
3	32
4	43
5	55
6	66
7	78

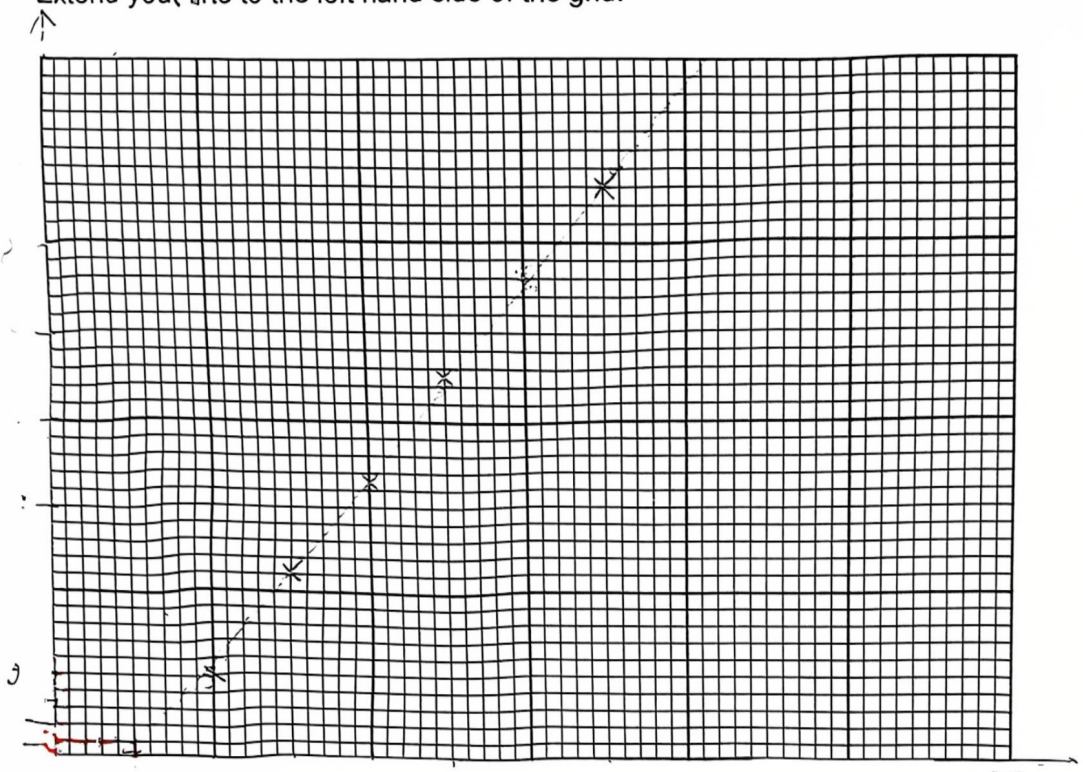
(i) What evidence in the table shows that all the reactions are exothermic?

..... [1]

(ii) Plot a graph of temperate rise against the number of carbon atoms in each alcohol molecule on the grid.

Draw a straight line of best fit.

Extend your line to the left hand side of the grid.



[4]

(c) The student repeats the experiment with methanol, CH_3OH.

The student uses the same number of moles of methanol as the other alcohols and the same volume of water.

Use your graph to predict the temperature rise for methanol.

.... ° C [1]

(d) The student predicts that the temperature rise with another alcohol is 90 °C.

(i) The student uses an initial water temperature of 20 °C.

Explain why it is not possible to obtain a temperature rise of 90 °C

..... [1]

(ii) The student wants to obtain a temperature rise of 90 °C with this alcohol and the same apparatus.

Suggest one way the student can obtain a temperature rise of 90 °C.

..... [1]

[Total: 13]

3 **(a)** You are provided with two solutions, **R** and **S**.

Do the following tests on **R** and **S** and record your observations in the table.

Test and name any gas evolved.

test no.	test	observations with **R**	Observations with **S**
1	**(i)** To 1 cm depth of solution in a test-tube, add aqueous sodium hydroxide until a change is seen. **(ii)** To the mixture from **(i)**, add excess aqueous sodium hydroxide.		
2	**(i)** To 1 cm depth of solution in a test-tube, add aqueous ammonia until a change is seen. **(ii)** To the mixture from **(i)**, add excess aqueous ammonia. **(iii)** Put 1 cm depth of aqueous hydrogen peroxide in a boiling tube and put the boiling tube in the test tube rack. Add the 1 cm depth of mixture from **(ii)** to this boiling tube in the test tube rack **slowly**.		

3	**(i)** To 1 cm depth of solution in a test-tube, add an equal volume of dilute nitric acid. **(ii)** Pour half of the mixture from **(i)** into a test-tube and add an equal volume of aqueous barium nitrate. **(iii)** To the other half of the mixture from **(i)**, add an equal volume of aqueous silver nitrate.		

[6]

(b) Conclusion

A solid is used to prepare solution **R**.

The name of the solid is ..... .

A solid is used to prepare solution **S**.

The name of the solid is ..... .

[2]